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ASSESSMENT OF THE STRENGTH AND COIN VALUES OF SOME SELECTED NIGERIA METALLIC COINS

Wuritka, Enoch Gotring
Department of Industrial Design
Abubakar Tafawa Balewa University, Bauchi.
Email- wuritka.enoch@yahoo.co.uk

ABSTRACT

The purpose of the study was to provide assess a complete guide, via slating the criteria to be use as guide for authorities that guarantee coin contents. This material is specially written for guidance leading to standard coin design. The rigorous assessment was undertaken to *demonstrate* integral reasons for the rejection of the Nigerian coins by her collectors, following the issuance of the 50 Kobo 1 Naira and 2 Naira coins on the 28th February 2007 by the Central bank of Nigeria. This research work goes through all the criteria, necessary to pin point the major factors accompanying the coins' present status. Considerably, the qualities and strength of a coin determines its face-value that determines its gross-value, and the magnitude of the gap between the two values, determines its standard. This reason has attracted a number of tests to accomplish this research for proper comprehension of the rejection. Qualitative analysis test, metallographic tests, strength calculation; design analysis, durability test (corrosion test), coin valuation and the immediate assessment of responses to interviews, are well known to those acquainted to coin design activities. Several finding the coin rejection was known to be encouraged by the banking industry as well as the sub-standard ness of the coins, with the exception of the 50 Kobo coin which was ailed to pass all tests carried out.

INTRODUCTION

Coin is usually a piece of hard material, usually metal or metallic material, such as gold, silver, nickel, copper, bronze, aluminum or a combination of such metals, usually in the shape of disc, with specific weight and value, usually stamped each designs and inscriptions and most often, issued by authority of a government s guarantee of its exchange value and use as money (Mc. Nulty, l992). The use of cast-metal pieces as a medium of exchange is very ancient and probably developed out of the use in commerce of ordinary ingots of bronze and other metals that possessed an intrinsic value. Until the development of bills of exchange in medieval Europe and paper currency in medieval China, metal coins were the only such medium. Despite their diminished use in most commercial transactions, coins are still indispensable to modem economies; in fact, their importance is growing as the result of the widespread use of coin-operated machines (Carson 1970).

BACKGROUND OF STUDY

In a contemporary world it is accepted that the rejection of coins by its collectors is as a result of the contrast between the coins face-values and their market values. A coin face-value must concur with its gross-value. If a coin is rejected in the international market, then of course, it stands a lesser chance of being accepted in the local markets. This piece of work is a similitude of qualitative and quantitative analysis of metal compounds. The mechanical processes which include tests for fatigue, hardness, elasticity

or tensile strength, static tension and compression, fracture toughness, etc. are usually tests for engineering materials applications and not tests for the coin. Test for coin include corrosion, metallographic, qualitative analysis, design analysis and the value of the coin this piece of work will elaborate the qualities and strength of the 50 kobo, 1 naira and 2 naira coins issued on the 28 Feb, 2007 by the Central Bank of Nigeria.
It has been observed that the acceptance of the Nigerian coins diminishes as they are been released by time. However, the cause is not actually known for years but many have blamed it on the poor economy. Professionally all channels amounting to these results must be considered before one could actually pin point out the real cause of the coins present status after which may give birth to a final solution. A standard coin must exhibit the following characteristics for it to be accepted in both the international and local markets.

1. It must be light in weight and easy to carry about.
2. It must be able to withstand corrosion
3. It must be strong enough to stand high temperature and pressure without losing its shape or quality (distortion)
4. It must be acceptable by its collectors.

If any coin lacks any of these qualities, then it is termed sub-standard coin. (U.S Mints, 1992)

METHODOLOGY, METERIALS AND TESTS
Series of tests were performed to show the strength and qualities of the 50 kobo, 1naira and 2naira coins.

IDENTIFICATION OF SPECIMENS

The 1naira and 2naira coins showed elements of bimetallic presence, while that of 50 kobo wasn’t apparent. The 1naira and 2naira circumscribed rings are spitted, to a proper picture of the assemblage.

Suspicion of iron, in all the coins was as a result of the magnetic properties exhibited, all the coins, even in their disengaged status, which gave the researcher an idea 'closely examine the specimens and thereby carried out for the Metallographic test. In order to identify the core elements through the examination of their microstructure.

Structure

The methods used in the study work are those established by National and International bodies as the International Organization for Standardization (ISO), with head quarters in Geneva, and the American Society for Testing and Materials (ASTM), Philadelphia. The following tests were conducted for the purpose of achieving the strength and qualities of the wins samples, namely:

1. Metallographic test
2. Corrosion tests: salt spray and tropical humidity tests
3. Uniform strength Calculation of the coins
4. Qualitative analysis

MATERIALS AND METHODS

Materials

Conical flask with lid Petri dish, Thread, Sodium chloride , Hydrochloric acid, Gritting papers, Magnifying glass, White sheet papers, Fluorine, Sodium hydroxide, Natrium carbonate, Natrium sulphides, Conical flask, Spatula , Petri dish fungi and molds, Finger size files, Piece of fabric, Steel round pipes, Steel rod, Block hammer, Venire caliper, Divider, Ruler, Calculator Water, Graduated cylinder, Digital balance, Silicon carbide gritting papers of range; 120 to 600, Methyl spirit (methanol) , Nitrate acid, Cotton wool, Polishing machine and powder, Alumina cloth, Digital microscope

Methods

Standard testing methods have been established by the national and international bodies such as the International Organization for Standardization (ISO), with head quarters in Geneva, and the American Society for Testing and Materials (ASTM), Philadelphia. The following tests were carried out on the samples.

1. Metallographic test
2. Corrosion tests
3. Salt spray test
4. Tropical humidity test
5. Calculation of strength of uniform disc
6. Qualitative analysis
7. Design analysis
8. Questionnaire distribution
9. Coin valuation

The coins, samples need not be cut and filed. They were not mounted because they were too small to handle, thus, the first three stages of the procedure were neglected.

Grinding

This was done by using gritting papers of different grades ranged from 120, 180, 240, 320, 400 and 600 with 600 as the finest of all in terms of abrasion and 120 as the most coarse. The grit papers were made from silicon carbide. During grinding, the coin surface is rubbed against the grit papers, one grade after the other until the 600 grade is reached thereby bringing the coin surface to absolute *plain,* flat and fine. During this process, water was applied to cool off the heat emitted from friction, which can alter the crystalline structure of the sample. After the grinding, it was deduced that the coin samples were all made of the same metals- ferrite. The 1N and 2N coins were electroplated using brass and copper respectively.

Polishing: This is done on a polishing machine. The alumina cloth was spread over the polishing wheel of the machine and tightened at the circumference of the wheel, The polishing powder was also spread on the cloth and the machine was powered. The polishing wheel rotates in the anti-clock wise direction while the sample was hand held and was slowly moved in the clock wise direction to avoid micro concentric marks. During this operation, water was continuously applied to the doth in order to [reduce heat erupted during friction. The samples attained a mirror-like surface.

Etching: 2ml of nitric add was added to 98m1 of methyl spirit, producing 2% natal which is the etchant for steel or Iron. A piece of cotton wool was dipped into the [solution and was gently rubbed over the mirror surfaces of the coins samples. The Lmlrror surface went matt or blurred, indicating that the metal pieces were actually steel. As shown in figure 1.

RGURE.1. showing etched samples.

50kobo 1naira 2naira

Microscopy: The viewing of the micro-structure of an element under the microscope and being able to interpret the result is termed microscopy. A digital microscope was used to capture the micro-structure of these coins samples.

Precautions

1. The samples surfaces were not touched after etching
2. The methyl spirit was carefully added to the nitric acid and not vice versa
3. The sample was held lightly against the polishing wheel during polishing
4. All used cotton wool were kept away
5. During the grinding process, the samples were rubbed against the abrasives.

Qualitative Analysis Test (constituents of the coins)

Compounds or elements were identified through certain properties and characteristics which they exhibit. Metal elements are easily identified through their colours, magnetic properties, streaks and etchants. The metal streak reveals the true colour of element especially crystalline elements where as the metal etching solution is called an etchant. Different metals have different etchants.

AIM

To confirm the presence of copper, brass and nickel or silver as metals used to electroplate the iron (ferrite).

APPARATUS

Hydrochloric acid, nitric acid, Dutch Mordant, methyl spirit, gritting papers of 600 grade, magnifying glass (optional) white sheet of papers, fluorine, alkalis, [sodium hydroxide (NaOH), Natrium Carbonate (Na2CO3), Natrium Sulphate (Na2SO4)1, Sodium Chloride, graduated cylinder, conical flask, spatula, Petri dishes, water, fungi and molds, finger size file, a piece of fabric, round pipes about the circumference of the samples (1 and 2 naira), a metal rod about the size of the inner disc of the coins and a block hammer

PROCEDURE

Standard Procedure were used to separate the 1 Naira and 2 Naira discs from their respective rings. Here, the samples are mounted on the round pipes and the fabric tied around the metal rod tip, which was then place upon the inner disc and a gentle blow was descended on it. The blow sends the inner disc of the coin out of the ring while the fabric prevents the disc from scratches. Each sample was grinded using the gritting papers and their streaks were collected for physical examination using the magnifying glass and inferences were recorded. The 1 Naira disc and 2 Naira ring were understood to have the semblance of brass and copper respectively, while that of the outer ring of 1 Naira, 2 Naira disc and the 50 Kobo coin were the semblance of nickel or for the outer layer and iron for the coins' core revealed from the metallographic Test for nickel i. The samples namely; 50 Kobo, 1 Naira ring and 2 Naira disc were subjected to 20%, 30% and 40% concentration of sodium chloride solution, for 18 days, using Petri dish and graduated cylinders as apparatus as applied to the corrosion test and readings were taken at 72hrs intervals. Fresh samples of the above named, were further subjected to Sm) diluted fluorine and left foris days, Readings were taken at every 72hrs interval. Fresh samples of the above named samples were also subjected to Sm) each of alkalis (Sodium hydroxide (NaOH), Sodium Carbonate (Na_3CO_3), Sodium Sulphate (Na_2SO_3, each on a separate Petri dish and left to react for 18 days, and readings were taken every 72 hrs. Fresh samples of the above named samples were also subjected to 15 g of paste carrying fungi and molds for 18 days and readings were taken accordingly. A sample was then subjected to 600°celsius for 10 minutes without distortion and observations and reading were made Testing for copper The 2 Naira circumferential ring has the semblance of copper and for confirmation, it was subjected to the following;

i. The sample was put on the Petri dish and some drops of concentrated nitric acid were added to the samples. This was also repeated for a 50% diluted nitric acid and the observations were recorded
ii. The sample was set as in (I) above substituting nitric acid for hydrochloric acid and the observations were recorded.

Test for Brass

The finger size file was used to file out some fine brass streak which was collected on a white piece of paper; it was then transferred to a Petri where some drops of nitric acid were added to confirm the presence of zinc and copper from the reaction. Observations were then recorded.

Corrosion Testing

A characteristic of metal is for it to disintegrate and return to its natural state. This disiritegration process is rust. For example, iron oxide is a basic ore for iron and steel.(Mitra, 1982). Testing for breakdown or deterioration of materials under exposure to a particular type of environment has greatly increased in recent years. Mechanical, thermal or electrical property tests often are performed on a material before, during or after its exposure to some controlled environment. Property changes are recorded as a function of exposure with time. Environments may include heat, moisture, chemicals, radiation, electricity, biological substances or some combination thereof. Thus, the tensile strength of a material may fall after exposure to heat, moisture, or salt spray or may be increased by radiation or electrical current. Strength of organic materials may be lessened by certain classes of fungus or mold. Corrosion testing is performed to ascertain the performance of metals and other materials in the presence of various electrolytes. Testing may involve total immersion, as would be encountered in sea water, or exposure to salt fog, as it is encountered in chemical industry processing operations or near the oceans where sea water may occur in fogs. Materials are generally immersed in a 5% or 20% solution of sodium chloride or calcium chloride in water, or the solution may be sprayed into a chamber where the specimens are freely suspended. In suspension testing, care is taken to prevent condensate from dripping from one specimen onto another The specimens are exposed to the hostile environment for some time, then removed and examined for visible evidence of corrosion, In many cases, mechanical tests after corrosion exposure are performed quantitatively to ascertain mechanical degradation of the material. In other tests, materials are stressed while in the corrosive environment. Still other test procedures have been developed to measure corrosion of metals by flue or stack gas. (Baboian and Dean, 1990).

Corrosion Testing Techniques

The *three* most popular corrosion tests are:

1. Salt spray test;
2. The humidity or tropical test; (suspension test)
3. Sulphur dioxide test (Mitra, 1982)

The Corrosion Test

This is the most commonly used corrosion test for metals. The common is diluted in water at different concentration for a period of time and results are recorded accordingly.

Aim: To measure percentage deterioration or resistively to corrosion when coin is contact with a corrosive solution.

Apparatus: Conical flask, Petri dish, water, sodium chloride crystals, graduated cylinder, test tube, thread, flask lid, micro-gauge and spatula.

Procedure for Salt Spray Test

15m1 volume of the graduated cylinder was occupied by sodium chloride, using the spatula and 85m1 of another graduated cylinder was reached with water, and both the solvent and the solute were mixed in the conical flask while stirring until the sodium chloride crystals dissolved. Therefore approximately 15% of the total volume of the solution was sodium chloride. The coins samples were then placed in Petri dishes of sodium chloride and water solution and left for 18 days at STP, and readings and observations were recorded.

The Tropical Humidity Test

This test is also called the suspension test. It is the similitude of the reaction between the corrosive agents and that of the metal elements in the atmosphere. The vapours of the agents corrode the metal when exposed in such environment.

Procedure: Suspension Test. (Tropical and humidity)

The conical flask was used, containing the same concentration of sodium chloride as of the spray test. The samples were suspended using strings, firmly held to the lid (cork). Vapours from the solution, which is controlled by atmospheric temperature and pressure, react with the suspended samples which were left foris days and readings and observations were made.

Precautions: Care was taken to avoid condensate dropping from one specimen to the other. U. The solute was dissolved completely before immersion of specimens as regard the salt spray test. Ui. Suspension test was performed outside yet secured to allow variation of temperature, since the experiment is a simulation of the real world.

Calculation of the Uniform Strength of the Coins

A disc of uniform strength is one in which the values of radial and circumferential stresses are equal in magnitude for all values of radius r. This means that the disc of uniform strength must have a varying thickness. (Rajput, 2005). But in this case, these discs thicknesses are considered equal in all directions, even though the embossment of the portrait makes some differences so their values remain constant.

Aim: To calculate the strength of the individual coins calculating the Uniform Strength of 50 Kobo, 1 Naira and 2 Naira Coins. Let 6 = uniform stress in radial circumferential directions Volume of the element = rde. t.dr Centrifugal force acting on the element ABCD due to rotation = P .r.de.t.dr.w_2 r_2= P d e. t. d r. w_2 r_2 -- -r

Radial force on the face DC = rde.t.6

Radial force on the face AB = (r + dr) de. (t + dt) 6

Circumferential force on faces BC and DA = t. dr. 6

(Inclined at an angle dO/2 to the radial direction and considering equilibrium, we get

P de. t .dr. w_2r_2 + (r + dr) de (t ÷dt) 6 = rde.t. 6 + 2t. di. sin de/2. 6

(sin do/2 = 0/2, because do is very small)

Canceling de on both side, eqn (1) is simplified as follows:

P .t.dr.w_2r + rt 6 + rdt 6 + di. t. 6 + dr. dt. 6 = r. t. 6 + t. dr. 6
neglecting the product of small quantities, we get
P t. dr. w2r2 + r. dt. 6 = 0
6=dt/t=-P w2rdr
[dt/t=P w2r/6.dr or
Integrating both sides, we get,
Iogt = P w2r'/2 6 + loge
(Where logA is a constant of integration)
L.ogt/A = - P $w_2r_2/_2$ 6
pw_2r_2
t/A = e 26
I pW_2T_2
r = 04 = te, to = A, thickness of any radius, t = to e 26
where,
uniform stress in radial and circumferential directions.
W = Angular speed = 2nN/60 and N = speed of the rotor
Axial thickness at the centre
P = Density of material
r = radius (Rajput, 2005)

Design Analysis
A good design is that which has harmonious arrangements and colours, good texture, a good form, aM in harmonious proportion, coupled with good finishing and surface enrichment and yet, functional and conformance to specification.

AIM
To find some certain parameter value which can be use to evaluate the quality of the design

APPARATUS
Digital micro balance, venire caliper, divider, ruler and digital calculator.
Calculations
a. 50 Kobo coin
Diameter = 19mm
Thickness = height when placed on a face = 2mm
Mass = 3.53g
Therefore, volume = rde.t.dr = *nr2h* = 3.142 X 9.52X 2 = 567.131mm3
Area = r2 = 3.142 X **g2** =283.57mm2
Circumference = 2nr =2 *X* 3.142 X 9.5 = 69.70mm
Density = = = 0.006224 g/mm3
b. 1 Naira coin
Diameter = 21mm
Diameter of disc = 15mm
Thickness height when place on a face = 2mm
Mass = 5.38g
Mass of disc z 2.74g
Therefore, volume of coin = rde.t.dr nr2h = 3.142 X 10.52 X 2

=1382.48mm3
Volume of disc = 3.142 X 7,52 X 2 = 112.5mm3
Volume of ring = vol. of coin — vol. of disc = ctr2h - rtr2h
(3.142 x 10.52 X 2)— (3.142 X 7,52 X 2) = 1269.98mm3
Area = = 3.142 X 10.52 = 345.62mm2
Area of disc = *rtr2* = 3.142 X 7,52 = 176.74mm2
Area of ring = area of coin — area of disc = nr2 - nr2 = 168.89mm2
Circumference = Znr 2 X 3.142 X 10.5 =65.98mm
Circumference of disc 2nr = 2 X 3.142 X 7.5 = 47.13mm
Circumference of ring = 2nr - 2rtr = (3.142 X 10.5 X 2)— (3.142 X 7.5 X 2)
18,85mm
The 2 Naira coin
Diameter = 25mm
Diameter of disc = 18mm
Thickness = height when placed on a face =2mm
Mass 7.45g

i. Therefore, volume = rde.t.dr = rtr2h 3.142 X 12.52 X 2 = 981.875mm3 Volume of disc = rtr2h 3.142 X 92 X 2 = 509.90mm3
Volume of ring = vol. of coin — vol. of disc = rtr2h - nr2h
(3.142 X 12.52 X 2) - (3.142 X g2 X 2) =471.98mm3
ii. Area = aT2 = 3.142 X 12.52 = 490.94mm2
Area of disc = nr2 = 3.142 X g2 = 254.50mm2
Area of ring = area of coin — area of disc = *nr2* - nr2
(3,142 X 12.52)_ (3.142 X 92) = 236.44mm2
Circumference 2nr = 2 X 3.142 X 12.5 = 78.55mm
Circumference of disc = 2rtr = 2 X 3.142 X 9 = 56.56mm
Circumference of ring cir of coin — dr. of disc = 2nr - 2nr =
(2 X 3.142 X 12.5) -(2 X 3.142 X 9) = 21.99mm

COIN ASSESSMENT
AIM
To show the magnitude of the gap between the face- value and the gross coin-value of the coins

APPARATUS
Gritting paper of 600 grades and micro balance

PROCEDURE
The 2 Naira was weighed and recorded then its disc was removed and subjected to grinding until the brown colour was faded away arid the disc was as welt subjected to grinding until it loses its lustre. New reading was then taken and recorded. The 1Naira coin was weighed and recorded and its disc was removed from its ring [and as subjected to grinding until are metallic yellow colour faded away and the new reading *after* being weighed was recorded. The ring was also subjected to grinding 1until it loses its lustre and a new reading was recorded. The mass of the 50 kobo coin was recorded and it was also subjected to grinding until! loses its lustre and a new reading was recorded after

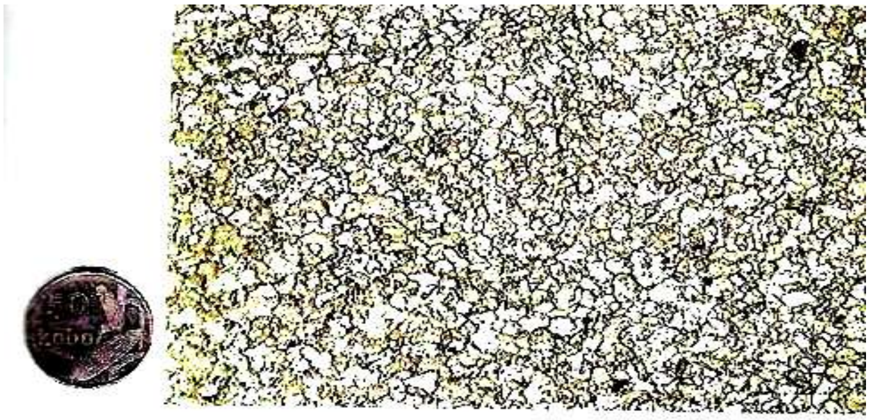
being weighed. If market survey for the prices of copper, brass, nickel and iron per kilogram was and their market values were recorded after which calculation b their masses and the magnitudes of the gaps between the face values and the gross values were estimated and recorded. - The results were used to compute the face-value of the coins which is compared to its gross-value or market value which then, gives the researcher the standard of the coins. Interactive Data Collection (Questionnaire)

AIM

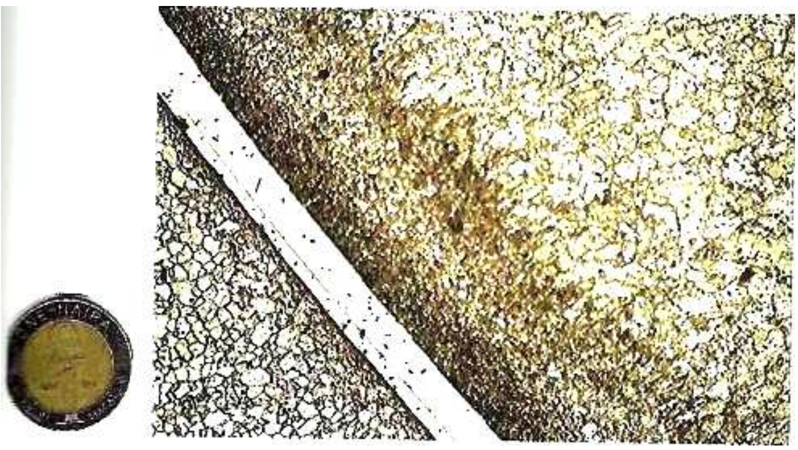
To get the view of the collectors on the rejection of the coins.

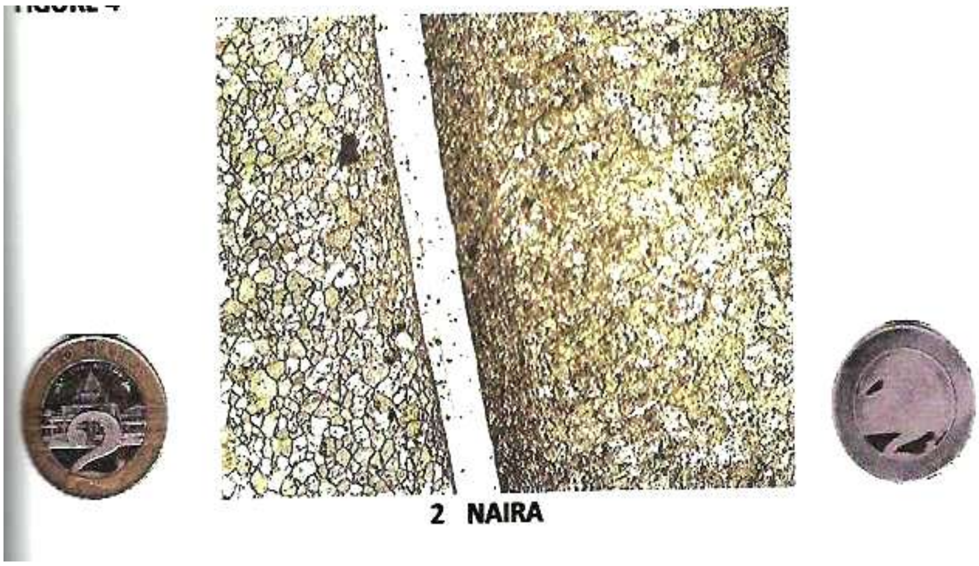
PROCEDURE

this was done by distributing thirty questionnaires containing six questions designed to produce data on the cause of coins rejection in the country. Ten were given to civil servants, another ten to those in private sectors, five to students in managerial discipline and five to students of other discipline. Responses were collected, iathered, calculated and analysed based on the general outcome of the responses.



50 KOBO





Inference of the Tests

The micro-structures are shown in the figures 4.1, 4.2 and 4.3 identifies the wins' core to be iron with negligible amount of carbon, confirming that the cores are of ferritic group with carbon contents as low as 0.002% and has the BCC micro-structure. They belong to the alpha iron.

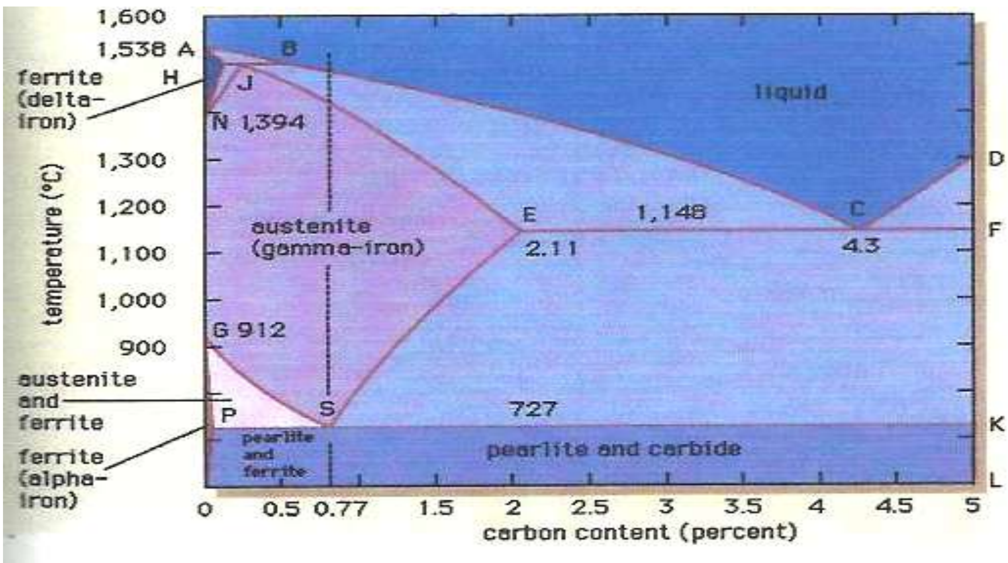


Figure 5. The iron carbon diagram

From the diagram above It can be deduced that the maximum content that the iron can contain is not more than 0.002%, meaning that that the carbon content is negligible and this characteristics makes It a ferrite (alpha iron) compounds of iron in the ÷3 state are called ferric and contain the Fe ion (which is yellow to orange to brown, depending on the extent of hydrolysis) or complex ions.

The most important oxidation states of iron are +2 and +3, though a number of +4 and +6 states are known. Three oxygen compounds of Iron are known: ferrous.....a, FeO; ferric oxide, Fe_2O_3 and ferrosoferric oxide, or ferroferric oxide, Fe_3O_4; which contains iron in both +2 and +3 oxidation states. Ferrous oxide Is a greenish to black powder used primarily as a pigment for glasses. (Hem *and* Arena, 2007).

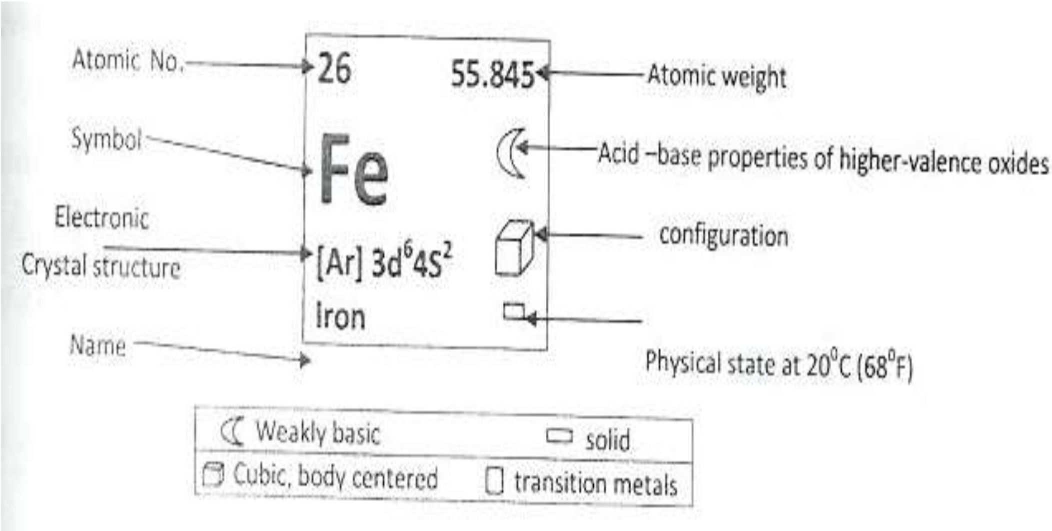


Table 1: basic information about and classification of iron

Symbol: Fe
Atomic No.: 26
Atomic weight: 55.845g
Standard state: solid at 298k
Group in periodic table:8
Period in periodic table: 4
Block in periodic table: d-block
Colour: lustrous, metallic silvery tinge
Classification: transition metal
Electronic configuration: 2-8-16
Iron (Fe) HARDNESS
Mineral hardness: 4
Brinell hardness: 490MPa
Vickers hardness: 608MPa

OBSERVATIONS FROM QUALITATIVE ANALYSIS
TEST FOR NICKEL OR SILVER

Reagents	Reaction of Metals with Time					
	3days (72hrs)	6days (144hrs)	9days (216hrs)	12days (288hrs)	15days (360hrs)	18days (432hrs)
NaCl	-	-	-	-	-	-
Fe	-	-	-	-	-	-
NaOH	-	-	-	-	-	-
Na_2CO_3	-	-	-	-	-	-
Na_2SO_4	-	-	-	-	-	-

Fungi and molds	-	-	-	-	-	-

Table 2: The reaction of Samples with different reagents

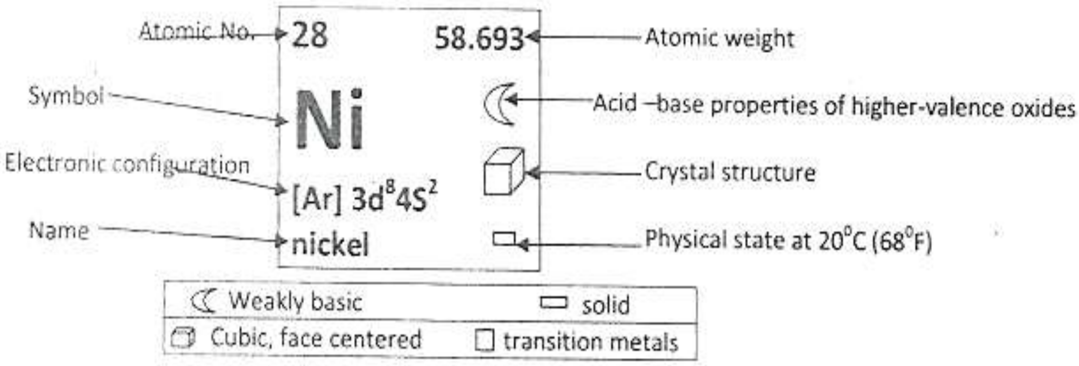
- Little or no physical change occurred when subjected to 20%, 30% and 40% concentration of sodium chloride solution.
- Little or no physical change occurred when subjected to fluorine
- Little or no physical change occurred when samples were subjected to 5m1 each of alkalis (sodium hydroxide (NaOH), Sodium Carbonate (Na_2CO_3), Sodium Sulphate (Na_2SO_4),
- Little or no physical change occurred when subjected to 15 g of paste carrying fungi and molds for 72hrs
- The samples were then subjected to heat of about 600°celcius without distortion, being evidence that they were not plated with silver.

RESULTS

The above results confirm that the outer layer of the 50 Kobo, 1 Naira ring and 2Naira disc were plated with nickel and not silver. Nickel's resistant to corrosion by fluorine, alkalis, and a variety of organic materials makes it an important constituent in coinage. It remains bright on indoor exposure but tarnishes outdoors, although its corrosion rate is very low. Its low corrosion rate, coupled with its resistance to corrosion by sodium chloride and other chlorides makes it essential for coin minting. Heavy nickel plating is employed as a lining for tank cars and as a coating for the inner walls of large pipes and similar equipment in the chemical industry. In figure below, the presence of Nickel, in the Nigerian coins is assessed.

Figure 6: The Nickel Plated Portion of the Coins

Nickel carbonyl [Ni (CO) 4], is an extremely toxic gas and exposure, should not exceed



0.007mg/rn3 Natural nickel consists of five stable isotopes: nickel-58 (68.27%), nickel-GO (26.10%), nickel-61 (1-13%), nickel-62 (3.59%) and nickel-64 (0.91%).
Symbol: Ni
Atomic No.: 28
Atomic weight: 58.693g
Standard state: solid at 298k
Group in periodic table: 10
Period in periodic table: 4
Block in periodic table: d-block
Colour: lustrous, metallic silvery tinge
Classification: transition metal
Electronic configuration: 2-8-16 -2
NICKEL HARDNESS
Mineral hardness: 4.0
Brinell hardness: 700MN/m^2
Vickers hardness: 638MN/m^2

ISOLATION OF NICKEL

It is not necessary to make nickel in the laboratory as it is available readily commercially. Small amount of pure nickel can be isolated in the laboratory through the purification of crude nickel with carbon monoxide. The intermediate in this process is highly toxic tetra carbonyl Ni (C04). The carbonyl decomposes on heating to about 250°C to form pure nickel powder.
Ni **+** 4C0 (250°C) = Ni (CO) 4 (230°C) = Ni **+** 4C0.
The Ni (CO) 4 is a volatile complex compound which is easily flushed from the reaction vessel as a gas leaving the impurities behind. Industrially, nickel oxides are reacted with "water gas", a mixture of CO **+** H2. The reduction of the oxide with hydrogen results in impure nickel. This reacts with the CO component of the water gas to make Ni(CO)4 as above. Thermal decomposition leaves pure nickel.

Observation from Copper Test

Nitric add was used on copper, but, to bite out large areas, Dutch mordant Is much better suited for this metal. The action of hydrochloric acid on copper was much more even and controlled than that of nitric add. For delicate, controlled etching, hydrochloric on copper is preferred.

Results

The observation confirms that the sample was electroplated using copper as shown below.

FIGURE *7:* The 2 Naira ring, electroplated using cooper metal

2 naira

Chemical Behavior of Copper

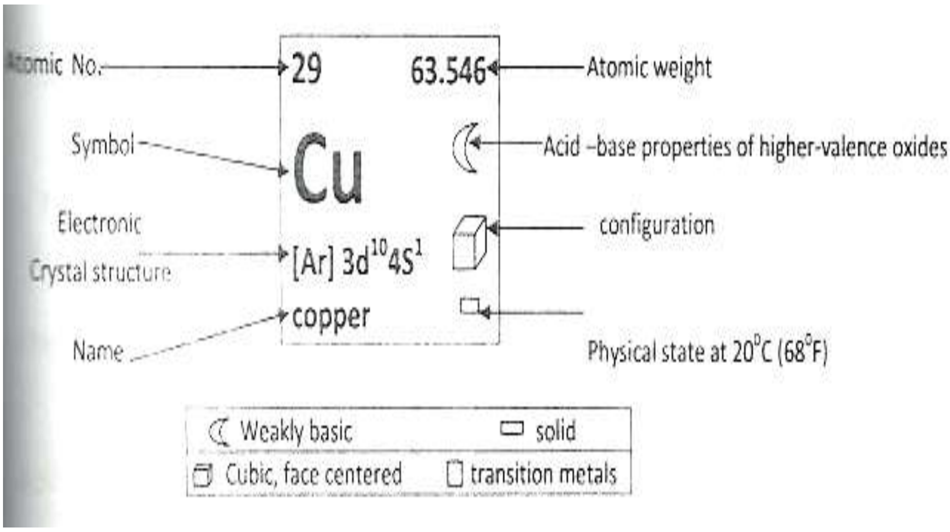
The result of adding different metal salts, to a burning reaction, of mixture of potassium, chlorate and sucrose has the following emission of colours. The red originates from strontium sulphate. The orange /yellow colour originates from sodium chloride. The green colour originates from barium chloride and the blue colour from copper (1) chloride. The lilac colour should be evidence from potassium chlorate. Copper (1) chloride salts imparts a blue colour flames. The flame generated at this point is relatively cool. The hotter flames, burn green because of emission from copper atoms

COPPER

Characteristics of Copper

Copper is one of the most important metals. Copper is reddish with a bright metallic luster. It is malleable, ductile and a good conductor of electricity (second to silver in electrical conductivity). Its alloys, brass and bronze, are very important. Apparently, the reason why police in the U.S are nicknamed "cops" or "coppers" is to do with their uniforms which use to have copper buttons. The most important compounds are oxide and sulphate, (blue vitriol). (Zumdah and Decoste, 2008)

TABLE 4: basic information about and classification of copper



Atomic weight: 63.546g
Standard state: solid at 198k
C.A.S registry I.D: 7440-50-8
Group in periodic table: 11 (transition metals)
Group name: Coinage metal
Period in periodic table: 4
Block in periodic table: d-block
Colour: copper metallic
Classification: metal
Electronic configuration: 2-8-18-1

PHYSICAL PROPERTIES OF COPPER

i. Temperature

Melting point: 1,357.77k Boiling point: 3,200k
Liquid range: 1,842.23k

ii. Expansion and Conduction

Thermal conductivity: 400wm'/k

COEFFICIENT OF THERMAL EXPANSION: 16.5 X 106/k2

iii. Bulk Properties

Density of solid: 8,920kg/rn3
Molar volume: 7.11cm3
Sound velocity: 3,570rn/s

iv. Elastic Properties

Young modulus: 13OGPa
Rigidity modulus: 48GPa
Bulk modulus: 14OGPa
Poisson ration: 0.34

v. Hardness

Mineral hardness: 3.0
Brinell hardness: 874M N/rn2
Vickers hardness: 369MN/m2

isolation

Copper metal is readily available commercially and so it is not normally necessary, to make it in the laboratory. Most copper production is based upon sulphide ores, containing little copper but quite a lot of iron. New cleaner technologies are now important, but older processes present major environmental problems. Complex procedures are used initially to form a form of copper sulphide appropriate for final reduction via a copper (1) oxide.

Test for Brass

The application of nitric acid drops upon the sample, develop air bubbles over the bitten area indicating the presence of Zinc. Under the bubbles the acid action is slower, and, therefore) if the bubbles are not constantly moved around by brushing, the etched tine will be uneven.

RESULT

With the above behaviour of the sample, indicating zinc whose colour isn't metallic yellow has confirmed that the above is a brass, the alloy of copper and zinc.

Figure 8: Sample indicating the brass electroplated area.

Brass

Zinc is a bluish-white, lustrous metal. It is brittle at ambient temperature but it's malleable at 100° to 150°C. It is a reasonable conductor of electricity and bums at high red heat with evolution of white clouds of oxide.

Coins	Initial Mass	3days (72hrs)	6days (144hrs)	9days (216hrs)	12days (288hrs)	15days (360hrs)	18days (432hrs)	Average Mass Lost	% Mass Lost
50 kobo	3.53	3.53	3.53	3.53	3.53	3.53	3.53	3.53	0
1 Naira	5.38	5.37	5.34	5.29	5.26	5.23	5.21	0.12	2.79
2 Naira	7.45	7.42	7.38	7.33	7.30	7.27	7.25	0.20	1.48

Symbol: Zn

Atomic No.: 30
Atomic weight 65.39g
Standard state: solid at 298k
C.A.S registry I.D: 7440-66-6
Group in periodic table: 12
Group name: Zinc group
Period in periodic table: 4
Black in periodic table: d-block
Colour: bluish pale grey
Classification: metallic
Electronic configuration: 2-8-18-2

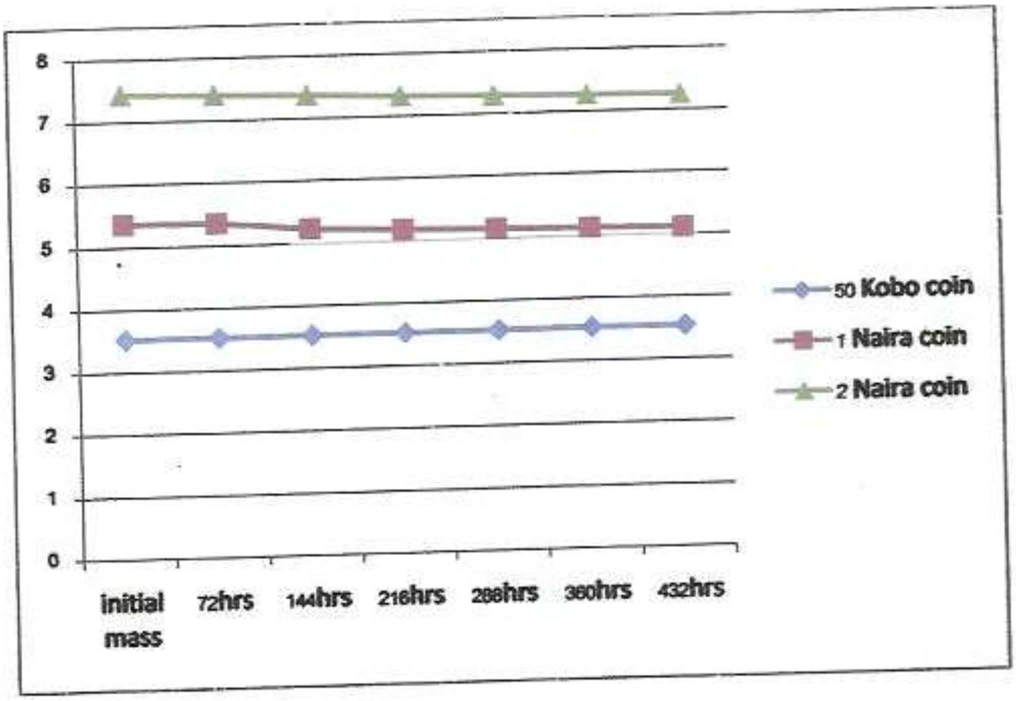
I. Hardness
Mineral hardness: 2.5
Brinell hardness: 412MN/m^2

Corrosion (deterioration of the coins)
Table 6: deterioration results for salt spray test. All measurements in the table below are in grams

The above table shows that the initial masses of the 50 Kobo, 1 Naira and 2 Naira coins were 3.35g, S.38g and 7.45g respectively, being in sodium chloride solution for 72hrs, they diminished in mass with the exception of the 50 Kobo coin. The 1 Naira coin, diminished by 0.0lg and the 2 Naira, coin diminished by 0.03g. As these experiment settings approached l44hrs, the 50 Kobo coin maintained its initial mass while the lF4aira and 2 Naira coins diminished by 0.13g and 0.04g. Respectively making a total mass lost of 0.14g and 0.07g respectively. At this point, the deterioration rate decreased, meaning that the slow deterioration rate between their initial masses and their first 72hrs in sodium chloride solution was as a result of the reaction between the sodium chloride and the coin surface enrichment medium.

Figure 7: Deteriorated coins samples from salt spray test

Figure 8: Graph of Deteriorated during salt spray test for 18days



It can be deduced from the graph above that the 50 Kobo coin has a high resistance to corrosion while the 1 Naira coin reacts swiftly when in contact with the corrosion medium. The 2 Naira coin has a corrosion rate slower than that of the 1 Naira.

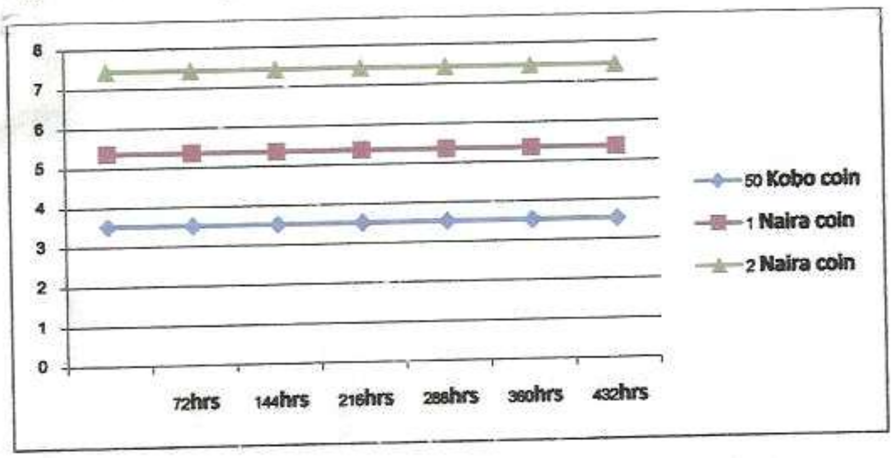
Table 7: deterioration results for tropical humidity test. All reading are in grams.

Figure 4.7.6: Corrosion from Tropical Humidity Test.

Coins	Initial Mass	3days (72hrs)	6days (144hrs)	9days (216hrs)	12days (288hrs)	15days (360hrs)	18days (432hrs)	Average Mass Lost	% Mass Lost
50 kobo	3.53	3.53	3.53	3.53	3.53	3.53	3.53	3.53	0
1 Naira	5.38	5.38	5.34	5.38	5.37	5.37	5.37	0.01	
2 Naira	7.45	7.45	7.45	7.45	7.44	7.44	7.44	0.01	

The above shows data extracted from the suspension test (humidity and tropical test). It shows that the 50 Kobo coin is resistive to its controlled environment. That is an environment of vapour from sodium chloride solution, being a similitude of sea water. The 1 Naira and 2 Naira coins reacted to their controlled environment. They corroded to some extent at a low rate of 0.16% each at the expiration of the test period. The rat of corrosion from the suspension test is gradual and one can predict that, since approximately 0.01g of mass is lost due to environmental factors in 432hrs, therefore, 1.0g is expected to be lost in 43,200hrs at same medium and corrosion rate.

Figure 4.7.5: Graph deterioration of during tropical humidity test for 18days.



Calculating the uniform strength of 50 kobo, 1 Naira and 2 Naira coins
(Where $\log_e A$ is a constant of integration)

$$\log_e \frac{t}{A} = -\rho\, w2r2/26$$
$$t/A = e\frac{-\rho w2r2}{2\sigma}$$

r = 0, t = tθ, t_0 = A, thickness of any radius, t = tθe $\frac{I\,\rho\, W2T2}{2\sigma}$

Where,
6 = uniform stress in radial and circumferential directions.
W = Angular speed = 2rcN/60 and N = speed of the rotor = 1 r.m.p
t_0 = Axial thickness at the centre
ρ = Density of material
r = radius (Rajput, 2005)
e = 2.27182818 = 2.72 = constant mathematical value of e

Please note that P w^2r^2 / 2σ has been expressed as $\frac{I\,\rho\, W2T2}{2\sigma}$ because of insufficient computer functions.

$$t = t_0 e \frac{1pw^2r^2}{2\sigma}$$

Divide through by to t_0

$$t = t_0 = e \frac{1pw^2r^2}{2\sigma} =$$

multiply through by *1/e*

$$t/t_0 \times 1/e = 1/e \times e \frac{1pw^2r^2}{2\sigma}$$

$t/t_0\ e = P\, w2r2/26$
$t / e\, t_0 = P\, w^2 r^2 / 2\sigma$
$t / e\, t_0 \times 2\sigma = \rho w^2 r^2$
$\sigma\,(2t/et_0) = \rho\, w^2r^2$
$\sigma = \rho\, w2r2/2t.\ et_0$ = to general formula

THE STREGNTH OF 50 KOBO COIN

$$\rho = \frac{mass}{volume} = \frac{3.53}{567.131} = 0.006224\ g/mm^3$$

$$w = \frac{2X3.142X1}{60} = 0.105mm/s$$ since the coin has uniform thickness from the edge to the centre,

T = t_0=2mm
r = 9.5

Therefore from the general formula $\sigma = \rho w^2 r^2/2t_0$. et, we have

$= \frac{0.006224 \times 0.1052 \times 90.252}{2X2}$ X 2.27182818 X 2 = 0.0070g/N

The Strength of 1 Naira Coin

$= \frac{Mass}{volume} = \frac{5.38}{1382.48} = 0.0039 \text{ g/mm}^3$

$W = \frac{2X3.142X1}{60} = 0.105\text{mm/s}$

t_o = 2mm

r = 10.5

therefore, from the general formula $\sigma = \rho w^2 r^2/2t_0$. et, we have

$= \frac{0.0039 \times 0.1052}{2X2}$ X $\frac{1032 \times 2.27182818}{}$ X 2 = O.005g/N

The Strength of 2 Naira Coin

$= \frac{Mass}{volume} = \frac{7.45}{981.86} = 0.0076$ g/mm3

$W = \rho \frac{2 \times 3.142 \times 1}{60} = 0.105\text{mm/s}$

t_o = 2mm

r= 12.5

Therefore from the general formula $\sigma = \rho w^2 r^2/2t_0$ et, we have

$= \frac{0.0076 \times 0.1052 \times 12.52 \times 2.27182818}{2 X2} \times 2$ = O.014g/N

DESIGN ANALYSIS

Table 8: STREAK TEST

Streak samples	Colour Examination	Inferences
50 Kobo, 1 Naira ring and2 Naira disc	Lustrous, metallic silver tinge.	Nickel or silver
1 Naira disc	Metallic yellow	Brass
2 Naira ring	Metallic brown	Copper

A good design is that which has a good and harmonious arrangement, colours, form and motifs in an orderly and harmonious pattern as well as good surface enrichment.

The surface enrichment of the coins is the well polished nickel which is used to plate the surface which also prevents it from rusting.

1. The portraits of the coins are outstanding as they are in harmony with the lettering and other designs embossed on the coins.

2. The colours are in harmony and the textures of the coins are good.
3. The coins are small and tight and their characteristics, therefore makes them easy to carry about except for the Kobo which the researcher feels is too small to handle and can easily drop a number of times.
4. The circumference, the area and the mass of the 1Naira and 2Naira coins concurred to other internationally accepted coins.

QUESTIONNAIRE ANALYSIS

This section consists of data collected on the research questions stated. In collecting the data, fifty questionnaires were distributed to the respondents. However, only twenty four (24) questionnaires were retrieved. The responses provided for the purpose of this study have been analysed and presented in the following ways:

RESEARCH QUESTION 1

Are the qualities and designs of the coins responsible for their rejection?

Table 9: The Corn Quality Immediate Responses.

S/NO	ITEMS	X	REMARKS
1	Do these coins have beautiful design?	24	Agreed
2	Do you think the coin quality is of international standard?	15	Agreed
3	These coins are better than the previous ones.	19	Disagreed
4	Do you think coins can stand that of the international community?	17	Agreed
5	The poor coin quality should be responsible for its rejection	24	Disagreed

Field Survey 2010

S/NO	ITEMS	X	REMARKS
1	Do you agree that the commercial banks contributed to the rejection of the coins	24	Agreed
2	Does the bank accept the coins over the counter?	24	Disagreed
3	Would you accept these when given to you over the counter?	15	Agreed
4	Did you spend these coins in 2007?	17	Positive
5	MEAN	20	

Table above shows that the respondents disagreed with items 3 and 5, and agreed with items 1, 2 and 4 in respect of the research question above. A mean score of 19.8 indicates that the coins are not being rejected on the ground of poor qualities and designs.

RESEARCH QUESTION 2

Is the banking industry responsible for the coin rejection?

Table 10: Coins and Commercial banking

Field Survey 2010

Table above shows that the respondents disagreed with items 2 and agreed with items 1, 3 and 4 in respect of the research question above. A mean score of 20 indicates that the coins are being due to lost of support from the commercial banks.

RESEARCH QUESTION 3

Is the Nation's economy responsible for the coins rejections?

Table 11: Rejection of the coins on the economic ground.

S/NO	ITEMS	X	REMARKS
1	Is the National economy responsible for the coin rejection?	13	Disagreed
2	Have you spent theses coins before?	19	Agreed
3	Will you accept these coins as change	15	Agreed
4	Do you think withdrawing these coins from circulation would do the economy good?	24	Disagreed
5	MEAN	17.7	

Field Survey 2010

Table above shows that the respondents disagreed with items 1 and 4 and agreed with items 2 and 4 in respect of the research question above. A mean score of 17.7 indicates that the issue of the coins rejection on economic ground breaks even with the respondents.

VALUATION AND STANDARDISATION OF THE COINS

TabIel2: Data from market survey

METAL	COST PER KILOGRAM
Nickel	₦250.00
Copper	₦120.00
Brass	₦60.00
Iron	₦5.00

Field Survey 2007

The 50 Kobo Coin

Initial mass = 3.53g

Final mass = 2.OSYg'

Approximate mass of nickel = initial mass — final mass = (3.53 — 2.05)g = 1.48g

And l000g of nickel = ₦250

Thus, 1.48g = $\frac{1.48 \text{ X}250}{1000}$ = N0.37 worth of nickel

For ferrite (iron),

l000g = N5

And 50 kobo contains approximately 2.05g

l000g = N5

Thus, 2.05g = $\frac{2.05.5}{1000}$ = N0.10 worth of iron

Therefore the face –value of 50 Kobo = 0.37 + 0.10 = N0.38 = 38Kobo

Results

2.05g

Face-value = 038

Gross-value = 50 Kobo

Therefore standard of the coin = 50 Kobo – 38 Kobo = 12 Kobo

Cost of production and surface enrichment are assumed for 12 kobo therefore the coin is standard.

The 1 Naira Coin

Initial mass of ring = 2.79g

Final mass of ring = 2.02g

Therefore nickel = 0.77g

And l000g = N250

So that $\frac{0.77 \text{ X } 250}{1000}$ = N0.19 worth of nickel.

For brass

Initial mass of disc = 2.74g

Final mass of disc = 2.11g

Therefore standard = N1.00 – N0.64 = 36kobo

The 1Naira coin face-value is approximately 64 Kobo. As stated in the U.S Mints, 1992 by Mary Mc. Culty that the face-value of a standard coin is closed its gross- value and that the closer, both values are the better. So the 1 Naira is actually substandard because of the gap magnitude between its face-value and its gross-value.

The 2 Naira coin.

Initial mass of ring = 3.78g

Final mass of ring = 3.30g

Initial mass of disc = 3.67g

Final mass of disc = 3.25g

1000g of nickel = N250

Therefore O.48g = $\frac{0.48 \text{ X} 250}{1000}$ = N0.12 worth of nickel.

For copper worth

l000g = N120. 00

Therefore 0.42g = $\frac{0.42 \text{ X } 120}{1000}$ = N0.050 worth of copper

Therefore iron = 3.2Sg **+** 3.30g = 6.55g

And l000g = N 5.00

Therefore 6.55g = $\frac{6.55 \text{ X } 5}{1000}$ = 0.033g

So that the face-value = 0.12 **+** 0.050 + 0.033 = N0.203
Face-value = 20Kobo
Gross-Value = N2.00
Standard value = N2.00 — 20Kobo = N1.80.
The 2Naira coin is worth approximately 20 Kabo and the cost of production couldn't be close to is value, so, the 2Naira coin is sub-standard because the gap magnitude between its face-value and gross- value is 9 times its worth.

FINDINGS AND DISCUSSION

The metallography performed revealed that the coins cores are made of iron which is an important engineering materials and a non-coinage material. Its value is relatively low and its abundance has made it cheap in the market. However, the coins are of good design, but what is the essence of a good non-functional design?

Evaluating 50 Kobo, 1 Naira and 2 Naira coins Base on Tests

Results from metallurgy has shown that over 50% of each coin mass was made of iron, which is not good at all, for according to Price and Trell (1997) " being made in most ages of precious metal, or alternatively possessing a substantial token value...". No token value can be deduced from the coins. From the qualitative analysis, it can be seen that only a small proportion or portion of the coins are made of valuable metals or alloy thereby contributing to the poor face- value of the coins. The metallography performed in chapter three revealed. The coins cores to be made of iron which is an important engineering materials and a non-coinage material. Its value is relatively low and its abundance has made it cheap in the market.

DATA COLLECTION

The data collected during the interactive session revealed that the banking industry played the major role towards the rejection of the coins in Nigeria. They issue out coins and frowned at collecting them, therefore breaking the banking cycle, which was also encouraged by the law makers who approved the minting of the coins without considering the regulations in their circulation. The entire qualities of the coins made it apparent that the coins were fiat money as stated by Mc. Nulty in her article in a U.S. Mints journal, "the market or gross-value of the coins were decreed by the government or authority who guarantees their contents and such coins are trade for close the cost of the material used in making them in the international market. Mc. Nulty (1992), had made it clear that three major criteria an object must meet to be a true coin;

1. It must be made of valuable material and trade for close to the market value of that material.
2. It must be made of standardized weight and purity
3. It must be marked to identify the authority that guarantees its contents.

Coins materials are meant to be relatively scarce, and this characteristic which they possessed made them expensive and worthy for exchange for goods and services.
Besides, the iron constituted over 50% of each of coin and the more valuable metals constituted lower than 50%.

Summary from Metallography

Coins materials are meant to be relatively scarce, and this characteristic which they possessed made them expensive and worthy for exchange for goods and services. Besides, the iron constituted over 50% of each of the coins and the more valuable metals constituted lower than 50%. Since the greater proportion of the coins constitute the less valuable metal which is relatively abundant and yet cheap, then the possibilities of such coins to be accepted by her collectors should be ruled out. One can conclude in this regard that these coins were produced or minted by the authority, without a target to ascertain their primary objectives, but with a target to meet a certain unknown objectives. For if the coins were to serve a specific purpose, then the regulations governing coinage should not be shun away.

Findings from Qualitative Analysis

From qualitative analysis of the coins, the constituting metals have shown that the nickel, copper and brass use in these coinages were as a result of the quest for beauty and not functional. The ferrite, being the lowest carbon iron, electroplated with other more valuable metals were subjected to several alkalis which are commonly found around the collectors — offices, schools, homes etc. for example, sodium hydroxide can be found in soaps, natrium carbonate and natrium sulphate could be found in detergents and sodium chloride, being the common salt can be found in foods and beverages. A rapid reaction occurs when any of these coins comes in contact with any of these corrosion media except for the nickel plated areas which might stand to resist deformity. From coin valuation exercise conducted, it was deduced that only the face-value and gross-value of the SO Kobo coin had an averagely closed gap whereas the 1 Naira and 2 Naira coins had the strengths and designs and lack durability, resistivity, standard and value.

Corrosion

The rate at which the 1 Naira and 2Naira coins corroded predict the tendency of the metal distortion in no time, meaning that since an average of 0.12g of 1 Naira and 0.20g of 2 Naira coins diminished in a 40% concentration of sodium chloride solution per 72hrs and findings have shown that approximately 2.llg of brass used in electroplate the ferrite, this means that the entire brass used in electroplating the 1 Naira would be completely corroded in

Q.12g 72hrs

Therefore 2.llg = $\frac{2.11 \times 72}{0.61}$ = 249hrs

Deterioration Calculation

For 50 Kobo coin, the deterioration rate is 0 for 432hrs, but physical observation, shows that its luster, tarnishes, so that one cannot conveniently rule out the possibilities that with time longer than experimented, the 50 Kobo will eventually diminish in mass as well. This is because as soon as the protective nickel plate worn out, the coin is sure to show evidence of corrosion in less than Z4hrs (being a typical behaviour of iron). Calculating deterioration rate for 1Naira and 2 Naira coin at 40% NaCI concentration. The period is calculated as the difference between two successive time limits.

Table 13: Calculating Deterioration Rate for 1 Naira

Period (Hrs)	Mass deteriorated (g)	Deterioration rate (%)
72	0.01	0.19
144	0.03	0.56
216	0.05	0.95
288	0.03	0.59
360	0.03	0.05
432	0.02	0.39
Total	**0.17**	**4.59**
Average	**0.030.19**	**0.46**

The table above shows the deterioration rate of the 1Naira coin with the mass deteriorated calculated from the difference in mass per period and the percentage of taken over the previous period. For example 72hrs to 144hrs, the difference in mass is divided by the mass as at 72hrs multiplied by 100

Table 14: Calculating Deterioration Rate for 2 Naira

Period (Hrs)	Mass deteriorated (g)	Deterioration rate (%)
72	0.03	0.40
144	0.04	0.54
216	0.05	0.68
288	0.03	0.41
360	0.03	0.41
432	0.02	0.23
Total	**0.20**	**2.67**
Average	**0.033**	**0.45**

The same procedure which was applied to the 1Naira coin deterioration table above was applied to the 2Naira table above in calculating the rate of corrosion

Discussion on Deterioration Rate

The above representation inferred that at ***fl*** hours, the corrosion rate of the 1 Naira coin was slow, and then at l44hrs, there was a rapid rate of corrosion. This indicates that, the coin sample must have been polished with some sort of solvent that has resistance to corrosion, thereby protecting the coin against a short term contact with corrosive medium or media. Soon as the corrosion medium was etched away arid the metal becomes apparent to the solution, the rate of corrosion escalates. The definition of the corrosion rate from l44hrs to 360hrs was as a result of saturation *during* chemical equilibrium, at this stage, the reaction becomes slow because of the rate of the forward reaction becomes equal to the rate of the backwards reaction. The lost of mass in the 1 Naira coin is as a result of the decomposition of the brass metal in the design, being an equal lost in the entire 1 Naira coin. This same principle applies to the 2 Naira coin using having the copper as its deteriorating coat.

Conclusion on Qualitative Analysis

One tentatively, could conclude that after having examined all the respective tests and analysis, that with the exception of the 50 Kobo coin, all other coins have failed to meet the criteria needed for a true coin

Table 13: The data collected during interactive sessions re

Coins	Durability	Strength	Design (Beauty)	Resistivity (corrosion)	Handling (Weight)	Standard
50 Kobo	1	1	0	1	0	0
1Naira	-1	1	1	-1	0	-1
2Naira	-1	1	1	-1	0	-1

Keys

-1 = below average
o = average
1 = above average
Evaluation of the 50 Kobo, 1 Naira and 2 Naira coins
Evaluating the 50 Kobo coin = 1+1+0+1+0+0 = 3 /6 = 1/2 , = 50%
For 1 and 2 Naira coins each of the same level of standard, therefore -1+1+1-1+0-1 = -1/6 = -16.6%. If 0 is the average point of standard, then the 50 Kobo coin of high coinage standard, well above average whereas the 1Naira and 2Naira coins are below the standard of coinage, as shown in the figure below.

OBSERVATION, CONCLUSION AND RECOMMENDATION

Observation

From the metallography of the coins sample, it is obviously that the coins' cores were made of ferrite, being the lowest form of steel, that is, the combination of iron and carbon, But, the carbon iron present being 0.002% or less. As for the ferrite in the coin samples, the carbon content is virtually negligible because the carbon atoms are below 0.002%. The iron in 50 Kobo is approximately 58%, while that of 1 naira is 74.7% and 2 Naira is 88%. It is being observed from the qualitative analysis that the 50 Kobo is a bimetallic compound consisting of ferrite of 58% being electroplated with 42% of nickel and the 1 Naira, is trimetaIlic, a composition of ferrite of 74%, nickel of 14% and brass of 12 % being an alloy of copper and zinc. The 2 Naira coin is a tn-metallic coin with the composition of copper, 5.64%, nickel 6.36% and 88% ferrite (iron). It was difficult to differentiate between nickel and silver but their difference was determined from their melting points. Silver being a soft metal could not stand a temperature as high as 600°C, but nickel could because, its melting point is above a thousand degrees Celsius. If the coins were electroplated with silver, the temperature in which they were subjected to during the qualitative analysis test would have smelted the plated surfaces and the traces would be apparent. The samples being heated in an upright position at 600°C a downward movement of the melt *was* expected if it were silver. Observation made from the corrosion tests suggest that nickel was highly resistive to common corrosion media, which is which it was being used to enrich the surfaces of the coins apart from its lustrous characteristics. It was deduced that the rate of corrosion for copper and brass is rapid and that makes it easy for both coins to worn. From the calculation of the strength of the discs, being a general formula for calculating the strength of disc of uniform strength, it was observed that the coins can withstand certain temperature and pressure with the limits of the coins purpose. Application of very high pressure was actually necessary since the coins are not meant to serve an engineering purpose. It is being observed that these coins are standard of strength for the purpose they are meant to serve. From responses to the questionnaire, it became apparent that most respondents agreed to the fact that the banking industry was responsible for the rejection of the coins. If there was acceptance of the coins over the counter during deposition, all collectors would accept transactions with the coins.

Another observation made from the respondents, was the rejection of the popular believe that the coins' rejection was due to the country's bad economy that since they were small units of what is being spent, then let the coins be used to justify a perfect transaction and not mere working on assumptions. Observations from the coin assessment were the fact that only the 50 kobo coin fulfils the criteria for true coin. The magnitudes of the gaps between the face-values and gross-values of the 1 Naira and 2 Naira coins are vast. The poor standard of these coins makes them sub-standard in both the international and local markets since their values are determined by their face-values. The designs of the coins have passed through several channels to give them the best possible designs, colours, portraits, enrichments, forms and materials are harmonious and eye catching.

CONCLUSION

Based on the major criteria of a true coin, the researcher concludes this piece of work to finalize the state of the 50 Kobo, 1 Naira and 2 Naira Nigerian coins, issued on the 23 Feb, 2007 by the Central bank of Nigeria.

All these coins have met the following coinage requirements and criteria for true coin.

a. The designs of the coins, which determine the satisfaction to the eyes, about all physical factors being harmonious and uniformity in weight and size which they constitute.
b. The strength of the coins which is also well beyond average as regard to the purpose they serve and their receptivity to certain common factors like pressure and temperature of relatively high magnitude without distortion.

FAILURE TO TEST

a. The corrosion resistively of the 1 Naira and 2 Naira is very poor and if these coins remain in such an environment for given period of time, it becomes distorted, worn and rejected. If any of these coins comes in contact with any corrosive medium, it corrodes continuously even if it's being withdrawn from such an environment, unless treated.
b. The values of the coins with the exception of the 50 Kobo are poor to serve as collectors coins. The magnitude of the gap between their face-values and their gross-values is vast, therefore is concluded that they are fiat money. Money whose value is determined by the government who guarantees it contents. It also means that the spending status of the coin is limited within the country alone and its value

differs in the international communities, and since the coin couldn't meet the criteria of being a true coin, then it is short of coinage standard.

COIN REJECTION

At this point, it can be concluded that the coin rejection by its collectors can be traced to two major factors.

a. The reckless role played by the banking industry towards the acceptance of the coins over the counter. The fact that the banking industry forces these coins upon their customers (the collectors of the coins) during withdrawals, and the refusal to collect these coins during depositions was also a major avenue to withdraw the coins from circulations giving birth to the rejection of the coins.
b. The poor gross-value of the coins. The poor face-value of the coins had made it not acceptable by international market because its face-value can't be used to defend its gross-value and no one person would give out goods or service less than its worth. Before such coins are accepted internationally, their lace-values would be calculated and anew exchange rate would be determined and so every transaction with the coins would be based on these this exchange rate. Now, what would be the exchange of 2 Naira, whose face-value is approximately 20 Kobo? How many 20 Kobo would you have to give to complete a transaction?

RECOMMENDATION

If it becomes a primary issue that coins should be accepted in Nigeria, then the following are recommended

1. The face-value of the coins should be improved using valuable elements in order to tally with their gross-values.
2. Such that even if the collectors, acquire them in much quantity to be converted to Jewelleries, as in the cases of the past. The values of such Jewelleries wouldn't be far from the value of the coins
3. The banking industry should be given specific training on how to remain responsible for the circulation of coins. They should give their maximum support by accepting the coins over the counter during deposition by collectors.
4. The 1 Naira and 2 Naira coins should be subjected to high polishing to prevent the brass and copper from corroding.

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